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SPECIFICATION NO: NCS-1877
Issued: June 22, 1959

MARK 3 RECOVERY VEHICLE

DETAILED DEVELOPMENTAL SPECIFICATIONS

1. SCOPE

1.1 This specification covers the requirements of a Mark 3 Recovery Vehicle intended for use with the WS117L Vehicle system.

1.2 Mission - The mission of the recovery vehicle shall be to return a recovery payload from the WS117L vehicle on orbit to the prescribed total system recovery area on the earth's surface.

2. APPLICABLE DOCUMENTS

2.1 The following specifications, other publications and drawings of the issue specified herein shall be used as guides for this program.

SPECIFICATIONS

Military

MIL-Q-5923C (USAF) 15 March 1956	Quality Control Requirements, General
MIL-M-8090A (ASG) 29 February 1956	Mobility Requirements, Ground Support Equipment, General Specifications for
MIL-W-8160B 19 July 1957	Wiring, Guided Missile, Installation of
MIL-E-8189A (ASG) (1) 16 April 1957	Electronic Equipment, Guided Missiles General Specification for
MIL-A-8421A (USAF) 6 November 1956	Air Transportability Requirements General Specification for
MIL-I-8500A (ASG) 22 January 1954	Interchangeability and Replaceability, Physical, of Component Parts for Aircraft (including Guided Missiles)

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MIL-E-25366A 28 June 1957	Electric and Electronic Equipment, and Systems, Guided Missiles Installation of General Specification for
MIL-S-8512B 8 January 1958	Support Equipment, Aeronautical, Specification for the design of

General Electric

NCS - 1845 15 May 1959	General Environmental Requirements for Equipment to be Mated with the WS117L IIA

OTHER PUBLICATIONS

Military Standards

MIL-STD-129B 10 April 1957	Marking for Shipment and Storage
MIL-STD-130 4 March 1953	Identification and Marking of U.S. Military Property

Bulletins

USAF

Bul. 23 31 October 1957	Materials' and Processes

Air Force Navy Aeronautical

143d 19 August 1954	Specifications and Standards Use of

Department of Air Force, Navy and Commerce

AN C-5 March 1955	Strength of Metal Aircraft Elements

DRAWINGS

MSD Drawing 1156B
G.E. Drawing ~~133R535~~

3. REQUIREMENTS

3.1 Characteristics - The Mark 3 Recovery Vehicle shall consist of the recoverable shield and passive sensors, a recovery system including recovery aids, thrust cone

and orbit ejection system. The design of the Mark 3 Recovery Vehicle shall be such that it's capable of achieving the same missions as the Mark 2 Programs. The reentry vehicle, including shield, shall have a primary capability for air recovery, and shall, as a back up capability, survive water impact for water recovery in ~~a mild sea.~~

3.2 General -

3.2.1 Materials and Processes - Materials and processes selected by the contractor as applicable in whole or part, shall conform to specifications of the U. S. Air Force Specification Bulletin 23, and Air Force - Navy Civil Aeronautics Bulletin ANC-5. Wherever possible, economical and non-critical materials shall be utilized in keeping with the expendability and state of the art requirements for recovery vehicles.

3.2.2 Metals - Metals shall be of the corrosion-resistant type or shall be suitably protected to resist corrosion.

3.2.3 Standard Parts - Specifications and standards for all materials, parts, and Government certification approval of processes and equipment which are not specifically designated herein and which are selected by the contractor as applicable in whole or in part for the execution of this specification, shall be selected in accordance with ANA Bulletin 143, except as specified in Paragraph 3.2.3.1

3.2.3.1 AN or MIL Standard Parts - AN or MIL Standard Parts shall be used wherever they are suitable for the purpose as selected by the contractor as applicable, and shall be identified on the drawing by their part numbers. Commercial utility parts such as screws, nuts, cotter pins, bolts, etc. may be used provided they possess suitable properties and are replaceable by the AN or MIL standard parts without alteration, and provided the corresponding standard part numbers are referenced in the parts list, and if practicable, on the contractor's drawings. In application for which there is no AN or MIL standard part, commercial parts may be used provided they conform to all the requirements of this specification.

3.2.4 Dissimilar Metals for Electronic Equipment - Dissimilar metals shall not be used in intimate contact unless suitably protected against electrolytic corrosion. When it is necessary that any combination of such dissimilar metals be assembled, an interposing material compatible to each shall be used. Dissimilar metals shall be as defined in Paragraph 3.2.1.3.3 of Specification MIL-E-8189A (ASG).

3.2.5 Electronic Equipment Design - The design of all electronic equipment shall conform to the requirements of the developmental phase as set forth in Paragraph 3.1 of Specification MIL-E-8189A (ASG).

3.2.6 Installation of Electrical and Electronic Equipment - The installation of electrical and electronic equipment shall conform to the requirements of Specification MIL-E-25366, where applicable as defined by the contractor.

3.2.7 Wiring - Wiring shall be in accordance with the requirements of Specification MIL-W-8160, where applicable as defined by the contractor.

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3.3 Weight - The total weight of the Mark 3 Recovery Vehicle including modified GFE payload shall not exceed 300 pounds. A status report on weights shall appear in the monthly technical reports.

3.4 Identification and Marking - Identification and marking of recovery vehicles and components shall be in accordance with the requirements of Standard MIL-STD-130. External markings for Mark 3 RV shall be located in accordance with the applicable Lockheed Missile & Space Division drawings.

3.5 Interchangeability and Replaceability - Corresponding assemblies, components, and parts of the Mark 3 Recovery Vehicle, ~~including the~~ modified GFE ~~payload~~, shall be interchangeable or replaceable in accordance with the requirements of Specification MIL-I-8500. Interchangeability-Replaceability Working Lists shall be established and appended to this specification listing those assemblies, components, and parts which for interface of the RV with the WS117L air frame, or maintenance reasons need to be interchangeable or replaceable.

3.6 Design and Construction -

3.6.1 Mechanical Configuration - The design of the RV shall be within the dimensional limitations set forth in ~~G.E. drawing~~ 133R535. To accomplish and maintain proper interface requirements of the RV with the WS117L vehicle airframe all configuration changes shall be subject to the approval of LMSD. The interface shall be as shown in ~~G.E. dra~~wing ~~13~~3R535.

3.6.2 Electrical Configuration - The RV electrical system shall include the necessary wiring to accommodate the modified GFE payload, the recovery system and orbit ejection system.

3.6.2.1 Electrical System Interfaces - The electrical system interface shall be accomplished through the electrical connector-explosive disconnect which shall be similar to that indicated on LMSD 1156B. Connector pin assignments will be in accordance with LMSD. The LMSD wiring harness will apply a transfer signal at T-0 to the two 1-second pyrotechnic squibs which cause electrical separation after 1 second.

3.6.2.2 Power Grounds and Cabling - The following requirements shall be adhered to for the ground requirements for the Mark 3 Recovery Vehicle. Technical agreements on the Mark 2 SARV Program will apply to the Mark 3 Recovery Vehicle Program where applicable.

a. No ground signals shall be returned to the missile airframe.

b. Wiring shields for return signal circuits shall be avoided wherever possible.

c. All shields, where utilized, shall be isolated from each other in cable runs.

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3.6.3 Finish - The RV shall incorporate finish coatings compatible with environmental requirements.

3.6.4 Alignment - The c.g. of the RV should lie along on the longitudinal axis of the WS117L vehicle. Adequate means shall be provided for aligning the c.g. of the RV with the ejection rocket thrust axis.

3.6.5 Reliability - Reliability as specified herein shall be the probability of success of the Mark 3 Recovery Vehicle to perform satisfactorily for the time required and in the environments encountered in the accomplishment of a specified mission. The program to measure reliability shall consist of the development tests specified in Paragraph 4.3.

3.6.6 Storage Life - The recovery vehicle excluding the batteries and pyrotechnics shall be capable of being operated satisfactorily after storage for a period of four months in controlled environments.

3.7 Performance

3.7.1 Functional Performance - The recovery vehicle shall be designed to function within the limits of the WS117L vehicle performance factors defined herein.

3.7.1.1 WS117L Vehicle Exit Trajectory - The Mk 3 RV shall be designed to perform in the 98 mile exit trajectory as shown in Figures 1 and 2.

3.7.1.2 WS117L Vehicle Orbit Track - The Sentry Vehicle will operate on a nominal 90 minute polar orbit. The orbit will regress 5 degrees during flight. Launching shall be in a southerly direction occurring within 3 hours of twelve o'clock noon.

3.7.1.3 WS117L Vehicle Attitude - The WS117L vehicle shall be stabilized to the horizontal position (vehicle axis along orbit track aft and forward) with an accuracy of ±10°.

3.7.1.4 Flight Plan - The WS117L vehicle shall maintain the attitude set forth in Paragraph 3.7.1.3 until just prior to reentry phase. The vehicle will then be programmed to provide a retro angle of 120° (measured from the forward path true horizontal in the orbit plane). This retro angle shall be maintained to within ±2°. The azimuth deviation in the ejection attitude will be ±5°. The pitch and yaw rates in the ejection attitude will be random in nature with three sigma values or about 6° per minute maximum. The integrated vary by more than ±10° from the WS117L axis (this is in addition at the ±5° tolerance of the WS117L orientation). Reentry capsule ejection shall be initiated by programmed ground command as the vehicle passes over a predetermined ground communication station, and shall occur 20° prior to perigree. The total system dispersion shall be such that landing will be in the selected zone within an area not greater than 70 statute miles wide and 300 statute miles long. The recovery system shall provide day or night recovery over ocean areas. Ejection velocity of the recovery vehicle shall be 1300 feet per second, + 0 feet per second, -300 feet per second.

3.7.1.5 Recovery Vehicle/WS117L Vehicle Separation - LMSD shall furnish for separation four ejection springs with synchronized pin pullers. The difference in actuation times of the pin pullers shall not exceed 6 milliseconds.

3.7.2 Operation Time - Operating times for the vehicle operation is 10 hours. As an objective, provisions shall be made for providing surface recovery cooling.

3.7.3 Power Requirements

3.7.3.1 Separation Signal Requirements - The following pulse signals shall be programmed by the WS117L vehicle to the Mark 3 Recovery Vehicle:

a. T-82 sec arm signal: 28 volts, dc, non-regulated, 8.0 amps, 50 milliseconds.

b. T-1 sec transfer signal: 28 volts, dc, non-regulated, 30.0 amps, 50 milliseconds.

c. T-1.5 sec mechanical release of Mark 3 Recovery Vehicle by WS117L vehicle.

Driving voltages for items "a" and "b" shall be available for a minimum of 0.9 seconds.

3.7.3.2 Squibs and Other Pyrotechnic Devices - The electrical properties for squibs and other pyrotechnic devices shall be as listed herein. However, the design effort shall continue towards making them compatible with the WS117L practice, if practical.

Spin and Despin Rockets	Max. no fire current - .2 amp. for 5 minutes. Min. all fire current - 1.092 amps. Bridge Resistance -1 ± .25 ohm/bridge. 2 Bridge Wires per Unit.
Explosive Bolts	Max. no fire current - .2 amp. for 5 minutes. Min all fire current - 1.4 amps. Bridge Resistance - 1 ± .25 ohm/bridge. 2 Bridge Wires per Unit.
Retro Rocket	Max. no fire current - .45 amp. for 2 minutes. Min all fire current - 1.30 amps. Bridge Resistance - .7 ± .25 ohm/bridge. 2 squibs in parallel.
Thermal Relay	Max. no fire current - .5 amp. continuous. Fire Current - 8 amps., 50 milliseconds. Fuse Resistance -1.35 ± .15 ohms.

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Thermal Battery	Max. no fire current - .2 amp continuous. Min all fire current - .5 amp/bridge. Bridge Resistance -1.3 ohms/bridge. 2 bridges in parallel.
Explosive Disconnect Cell	Max. no fire current - 0.5 amp., Min. all fire current -2.0 amp., Bridge Resistance -1.2 ohms.
Ejection Piston	Max. no fire current - 0.5 amp., Min all fire current -2.0 amp., Bridge Resistance -1.0 ohm ± .2 ohm.
Pyrotechnic Switches	Max. no fire current -.1 amp., Min all fire current -.8 amp., Bridge Resistance - 1.75 ohm ± .75 ohm.
Dimple Motor	Maximum no fire current - 0.5 amp, Min. all fire current - 2.0 amp, Bridge Resistance - .5 ohm ± .3 ohm.
Power pack Pyro BI-1	Max. no fire current - .1 amp., Min all fire current - .5 amp. Bridge Resistance - 1.30 ohm ± .3 ohm.
Power pack Pyro BI-2	Max. no fire current - .1 amp/bridge, Min. all fire current - .5 amp/bridge. Bridge Resistance - 1.3 ohm ± .3 per bridge.
Batteries	Maximum no fire current - 0.200 amp, Min. all fire current - 2.0 amp. Bridge Resistance - 0.65 ohm.
Reefing Line Cutter for Cutting Piston Harness	Maximum no fire current - 0.5 amp. Min all fire current - 2.0 amp. Bridge Resistance - 1.0 ± 25% ohms.
Reefing Line Cutter	Mechanical Actuation.

3.7.3.3 Pyrotechnic Shorting Precaution - The following pyrotechnics must be shorted prior to pre-mating. This shall be done in such a manner that shorting may be conveniently removed at mating, as with plugs, and the required fuzing and/or firing circuit connections are made.

a. The retro-rockets igniter

b. Spin and de-spin rocket igniters

c. Explosive bolt squibs

d. Separation explosive piston squibs, both external and internal

3.7.4 Sensors and Transducers - The following will be provided:

a. Passive sensors on the inside face of the shield to measure micrometeorite impact.

b. A radiation film pack on the internal shield structure.

c. Temperature sensitive paint at suitable locations.

3.7.4.1 Instrumentation Frequencies - The recovery beacon shall be adjustable for the following frequencies:

231.4 Megacycles
232.4 Megacycles
235.0 Megacycles
237.8 Megacycles

3.7.5 Environmental Performance - The recovery vehicle shall be designed and constructed such that it will function satisfactorily when subjected to the environmental requirements of ~~NCS-1~~845, dated May 15, 1959.
MSD 6117A dated 30 June 1959

3.7.6 Recovery System - The recovery system shall consist of a checkered radar reflective, fire orange colored parachute, sea marker, radio beacon, beacon light and two puffs of radar chaff. Recovery parachute design will be for a velocity of 25 feet per second at 10,000 feet altitude, with stability comparable to the Mark 2 SARV parachute.

3.7.6.1 Chaff Requirements - The Mk 3 will dispense two 0.4 lb chaff packages during descent, so programmed as to provide two recognition targets on the radar scope of the recovery task force.

3.7.6.2 Chaff Frequency and Response - The chaff shall be capable of a theoretical radar response as follows:

Frequency	Response
S-Band 2880 mc	6,082 ft^2
X-Band 9375 mc	3,073 ft^2

3.7.6.3 Radio Beacon - The radio beacon shall be vertically polarized and shall operate at a frequency of 232.4 mc with a 1000 cps tone.

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3.7.6.4 Recovery Operating Time - The radio beacon and light shall be capable of operation for a period of ten hours after water impact.

3.7.6.5 Parachute Ejection Altitude - The parachute shall be ejected at an altitude of 55,000 ± 5,000 feet.

3.7.6.6 Parachute Air Recovery Loads - The loads applied to the parachute by air recovery shall not exceed 5 g's lateral and 15 g's axial.

3.7.6.7 Sea Marker - The sea marker shall be capable of maintaining a minimum 15 foot wide sea slick.

3.7.7 Reentry Instrumentation Payload - The reentry instrumentation payload shall consist of char measurement, shield liner temperature, shield internal temperature, longetudinal accelaration, and 3-axis magnetometer sensor; separation, ejection and recovery sequence monitoring; and transmitter, antenna and recorder elements. The reentry instrumentation payload will be completely independent of the sentry, except for pulse signal command to the payload programmer. The payload shall function 1 minute out of every 6 on orbit, based on a launch pulse command, and continuously after RV arming, based on arm signal command.

4. QUALITY ASSURANCE PROVISIONS

4.1 Inspection - The contractor shall provide for the inspection of material and parts in accordance with the requirements set forth in Specification MIL-Q-5923C, Phase A, with interpretation in Section 4.4 below.

4.2 Acceptance Tests - Acceptance tests, as defined herein, will be performed on the Recovery Vehicle, subsystems and components. These will consist of the following individual tests:

a. Visual inspection

b. Functional tests

c. Environmental tests

The details and levels of the above tests will be defined by the Mark 3 Recovery Vehicle System Test Specification for the system, and by separate preliminary specifications or test instructions for subsystem and components. The Recovery Vehicle acceptance test shall be performed by the contractor, monitored by LMSD and witnessed by USAF representatives.

4.3 Design Qualification Tests - Design qualification tests are those tests performed on samples which are representative of the development design for the purpose of meeting requirements of this specification. These tests will consist of the following individual tests as minimum requirements.

a. Environmental tests

b. Vibration survey tests

c. Cycle tests

d. Structure tests

e. Drop tests

f. Set-out tests

g. GSE compatibility tests

4.4 Quality Control System Scope - The following requirements shall establish the scope of the quality control system to be employed in accordance with Phase A of MIL-Q-5923C (UASF). A Quality Control Procedures Manual shall be prepared containing procedures necessary to implement the Phase A Quality Control System.

Function	Required
Sampling	no
Acceptance tests (100%)	yes, per Equipment Specification
Preproduction tests	no
~~Qualification tests~~	~~no~~ yes
Design qualification tests	yes, as Engineering Development test
Production tooling inspection	no
Manufacturing in-process inspection	no
Statistical Quality Control System	no
Mill run inspection	no
Preproduction samples	no
Preduction control samples	no
Vendor facility survey	no
Materials review	no
Drawing and change control	no, sketches maybe used
Raw material certification, test & analysis	In accordance with specific instructions in equip. drawings or specifications
Certification of parts, process, equipment and operating personnel	In accordance with specific instructions in equip. drawings or specifications
Interchangeability inspection	no

5. PREPARATION FOR DELIVERY

5.1 Preservation and Packaging - Preservation and packaging requirements for the Mark 3 Recovery Vehicle and its components shall be as specified on the individual equipment drawings.

5.2 Marking for Shipment - Marking for shipment shall be in accordance with the requirements of Standard MIL-STD-129.

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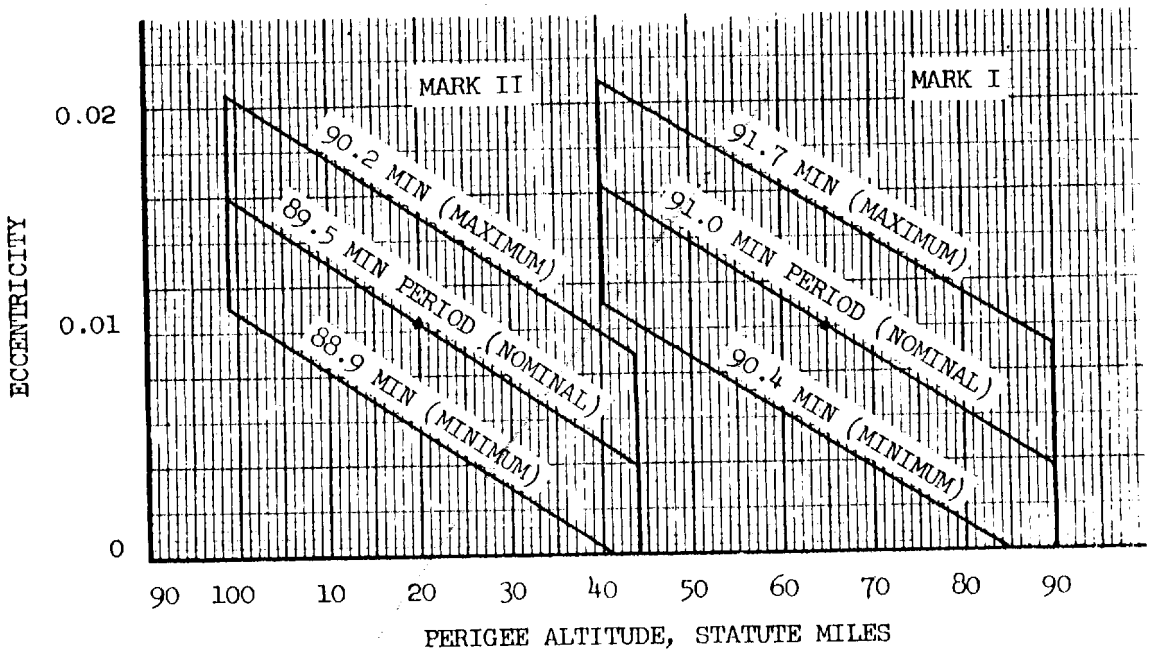

Figure 2

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